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RGB Image for Underwater Clear Image Acquisition by Using Multiscale Decomposition Method

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ABSTRACT: Images captured underwater generally degrade due to scattering and absorption. Low contrast, color distortion and poor visual appearance are the major issues that an underwater image has to undergo. Such problems were caused by dispersion and refraction of light as they penetrate from rarer to denser media. The scattering of light reduces color contrast. Here introduces an improved method for underwater image enhancement based on the fusion method that is capable to restore accurately underwater images. The proposed work takes a single image as the input and a sequence of operations such as white balancing, sharpening, manipulating weight maps are performed on the input image. Finally multiscale decomposition of the inputs is done to obtain the resultant output. In the initial stage, color distorted input image is white balanced to remove the color casts maintaining a realistic subsea image. In the second stage, CLAHE is performed on the gamma corrected image. CLAHE plays a significant role in luminance enhancement of underwater images. At the same time, histogram equalization is performed on the sharpened image. The weight maps analyze image characteristics that properly specify the spatial pixel relationship. Finally in the last stage, multiscale decomposition of input and weight map are performed. Result analysis the performance of underwater images using proposed method.

KEYWORDS: underwater image enhancement based on the fusion method that is capable to restore accurately underwater images, multiscale decomposition of the inputs is done to obtain the resultant output.

I. INTRODUCTION

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, the digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and we can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions digital image processing may be modeled in the form of multidimensional systems.

Image research is the descent of important info coming from photos; chiefly coming from electronic digital graphics with a digital picture control strategies. Photograph investigation tasks is usually as easy because meter reading pub coded tag cloud or even as innovative since determining a person via the encounter. Pcs are generally indispensable for that examination of huge numbers of data, pertaining to duties that requirement intricate computation, or for this removal of quantitative information.

Then again, we can establish the human being visual area is a great graphic examination apparatus, particularly for extracting higher-degree selective information, and for many applications including practice of medicine, safety measures, as well as rural realizing people analysts nevertheless cannot be changed simply by computer systems. This is why, quite a few important image analysis equipment for example side alarms in addition to neuronal communities are usually inspired through homo beholding designs.

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II. REVIEW OF LITERATURE REVIEW OF LITERATURE

ENHANCEMENT OF UNDERWATER IMAGES WITH STATISTICAL MODEL OF BACKGROUND LIGHT AND OPTIMIZATION OF TRANSMISSION MAP

Underwater images often have severe quality degradation and distortion due to light absorption and scattering in the water medium. A hazed image formation model is widely used to restore the image quality. It depends on two optical parameters: the background light (BL) and the transmission map (TM). Underwater images can also be enhanced by color and contrast correction from the perspective of image processing. In this paper, we propose an effective underwater image enhancement method for underwater images in composition of underwater image restoration and color correction. Firstly, a manually annotated background lights (MABLs) database is developed. With reference to the relationship between MABLs and the histogram distributions of various underwater images, robust statistical models of BLs estimation are provided. Next, the TM of R channel is roughly estimated based on the new underwater dark channel prior (NUDCP) via the statistic of clear and high resolution (HD) underwater images, then a scene depth map based on the underwater light attenuation prior (ULAP) and an adjusted reversed saturation map (ARSM) are applied to compensate and modify the coarse TM of R channel. Next, TMs of G-B channels are estimated based on the difference of attenuation ratios between R channel and G-B channels. Finally, to improve the color and contrast of the restored image with a dehazed and natural appearance, a variation of white balance is introduced as postprocessing. In order to guide the priority of underwater image enhancement, sufficient evaluations are conducted to discuss the impacts of the key parameters including BL and TM, and the importance of the color correction. Comparisons with other stateof-the-art methods demonstrate that our proposed underwater image enhancement method can achieve higher accuracy of estimated BLs, less computation time, more superior performance, and more valuable information retention.

UNDERWATER IMAGE ENHANCEMENT VIA MEDIUM TRANSMISSION-GUIDED MULTI-COLOR SPACE EMBEDDING:

Underwater images suffer from color casts and low contrast due to wavelength- and distance-dependent attenuation and scattering. To solve these two degradation issues, we present an underwater image enhancement network via medium transmission-guided multi-color space embedding, called Ucolor. Concretely, we first propose a multi-color space encoder network, which enriches the diversity of feature representations by incorporating the characteristics of different color spaces into a unified structure. Coupled with an attention mechanism, the most discriminative features extracted from multiple color spaces are adaptively integrated and highlighted. Inspired by underwater imaging physical models, we design a medium transmission (indicating the percentage of the scene radiance reaching the camera)- guided decoder network to enhance the response of network towards quality-degraded regions. As a result, our network can effectively improve the visual quality of underwater images by exploiting multiple color spaces embedding and the advantages of both physical model-based and learning-based methods. Extensive experiments demonstrate that our Ucolor achieves superior performance against state-of-the-art methods in terms of both visual quality and quantitative metrics.

UNDERWATER HYPERSPECTRAL TARGET DETECTION WITH BAND SELECTION:

Compared to multi-spectral imagery, hyperspectral imagery has very high spectral resolution with abundant spectral information. In underwater target detection, hyperspectral technology can be advantageous in the sense of a poor underwater imaging environment, complex background, or protective mechanism of aquatic organisms. Due to high data redundancy, slow imaging speed, and long processing of hyperspectral imagery, a direct use of hyperspectral images in detecting targets cannot meet the needs of rapid detection of underwater targets. To resolve this issue, a fast, hyperspectral underwater target detection approach using band selection (BS) is proposed. It first develops a constrained-target optimal index factor (OIF) band selection (CTOIFBS) to select a band subset with spectral wavelengths specifically responding to the targets of interest. Then, an underwater spectral imaging system integrated with the best-selected band subset is constructed for underwater target image acquisition. Finally, a constrained energy minimization (CEM) target detection algorithm is used to detect the desired underwater targets. Experimental results demonstrate that the band subset selected by CTOIFBS is more effective in detecting underwater targets compared to the other three existing BS methods, uniform band selection (UBS), minimum variance band priority (MinV-BP), and minimum variance band priority with OIF (MinV-BP-OIF). In addition, the results also show that the acquisition and

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detection speed of the designed underwater spectral acquisition system using CTOIFBS can be significantly improved over the original underwater hyperspectral image system without BS.

AN UNDERWATER IMAGE ENHANCEMENT METHOD FOR A PREPROCESSING FRAMEWORK BASED ON GENERATIVE ADVERSARIAL NETWORK:

This work presents an efficient underwater image enhancement method, named ECO-GAN, to address the challenges of color distortion, low contrast, and motion blur in underwater robot photography. The proposed method is built upon a preprocessing framework using a generative adversarial network. ECO-GAN incorporates a convolutional neural network that specifically targets three underwater issues: motion blur, low brightness, and color deviation. To optimize computation and inference speed, an encoder is employed to extract features, whereas different enhancement tasks are handled by dedicated decoders. Moreover, ECO-GAN employs cross-stage fusion modules between the decoders to strengthen the connection and enhance the quality of output images. The model is trained using supervised learning with paired datasets, enabling blind image enhancement without additional physical knowledge or prior information. Experimental results demonstrate that ECO-GAN effectively achieves denoising, deblurring, and color deviation removal simultaneously. Compared with methods relying on individual modules or simple combinations of multiple modules, our proposed method achieves superior underwater image enhancement and offers the flexibility for expansion into multiple underwater image enhancement functions.

UNDERWATER IMAGE ENHANCEMENT USING IMPROVED CNN BASED DEFOGGING:

Due to refraction, absorption, and scattering of light by suspended particles in water, underwater images are characterized by low contrast, blurred details, and color distortion. In this paper, a fusion algorithm to restore and enhance underwater images is proposed. It consists of a color restoration module, an end-to-end defogging module and a brightness equalization module. In the color restoration module, a color balance algorithm based on CIE Lab color model is proposed to alleviate the effect of color deviation in underwater images. In the end-to-end defogging module, one end is the input image and the other end is the output image. A CNN network is proposed to connect these two ends and to improve the contrast of the underwater images. In the CNN network, a sub-network is used to reduce the depth of the network that needs to be designed to obtain the same features. Several depth separable convolutions are used to reduce the amount of calculation parameters required during network training. The basic attention module is introduced to highlight some important areas in the image.

III. PROPOSED SYSTEM

In this work, propose a method for the contrast enhancement of the underwater images. The contribution of work lies in the contrast enhancement part. The contrast enhancement is performed based on histogram techniques. CLAHE is used for luminance improvement and histogram linearization is applied to sharpened image. This enhancement takes the input image, enhance the contrast of the image. The input image is white balanced using Grey World algorithm. The white balanced image is subjected to Gamma correction as well as sharpening. Both the images are directed to an enhancement module. The weight maps of input images are calculated. In multiscale decomposition, the inputs and weight maps are fused to obtain the final output.

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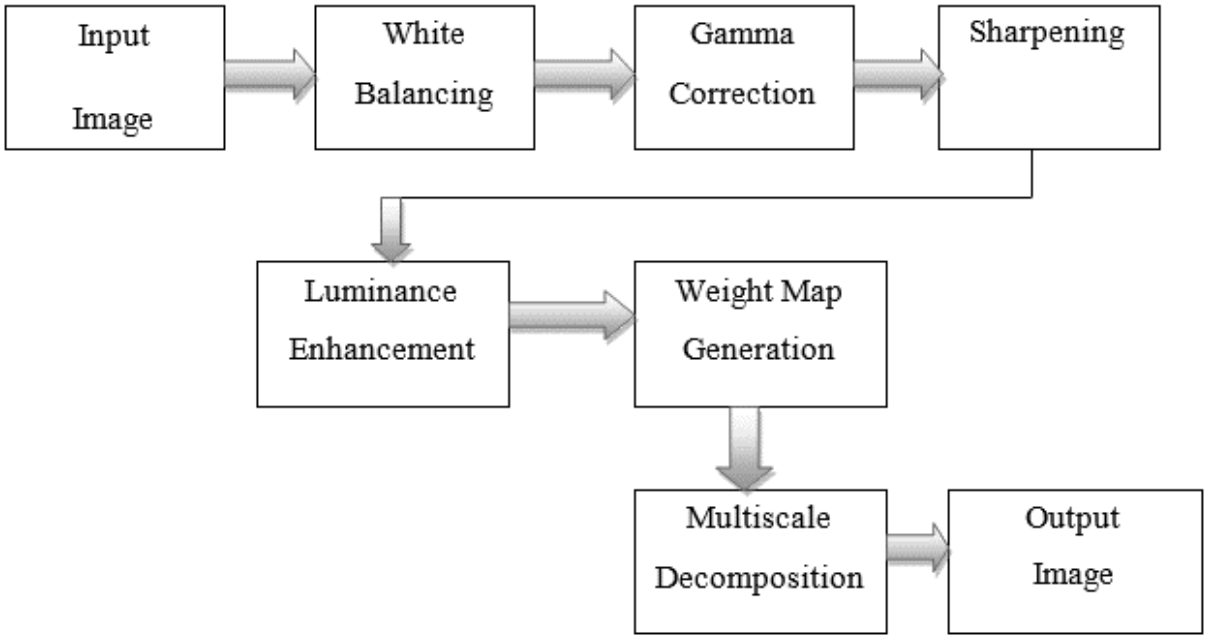

Fig 3.1 System Architecture

In this work, propose a method for the contrast enhancement of the underwater images. The contribution of work lies in the contrast enhancement part. The contrast enhancement is performed based on histogram techniques. CLAHE is used for luminance improvement and histogram linearzation is applied to sharpened image. This enhancement takes the input image, enhance the contrast of the image. More finer details can be visualized from the proposed method. The framework of proposed method is shown in Fig 3.1. In the framework, input image is white balanced using Grey World algorithm. The white balanced image is subjected to Gamma correction as well as sharpening. Both the images are directed to an enhancement module. The weight maps of input images are calculated. In Multiscale fusion, the inputs and weight maps are fused to obtain the final output.

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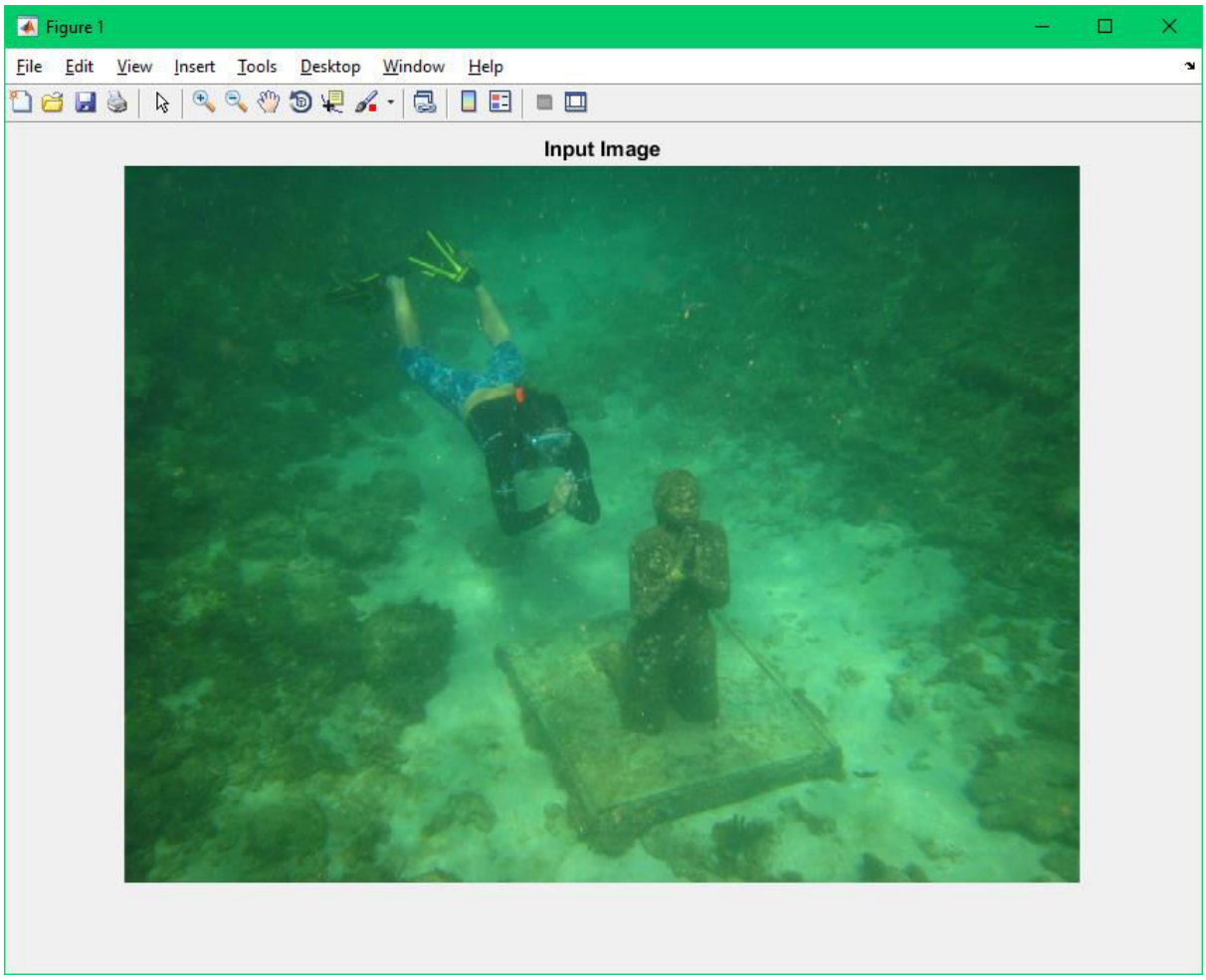
IV. RESULT AND DISCUSSION



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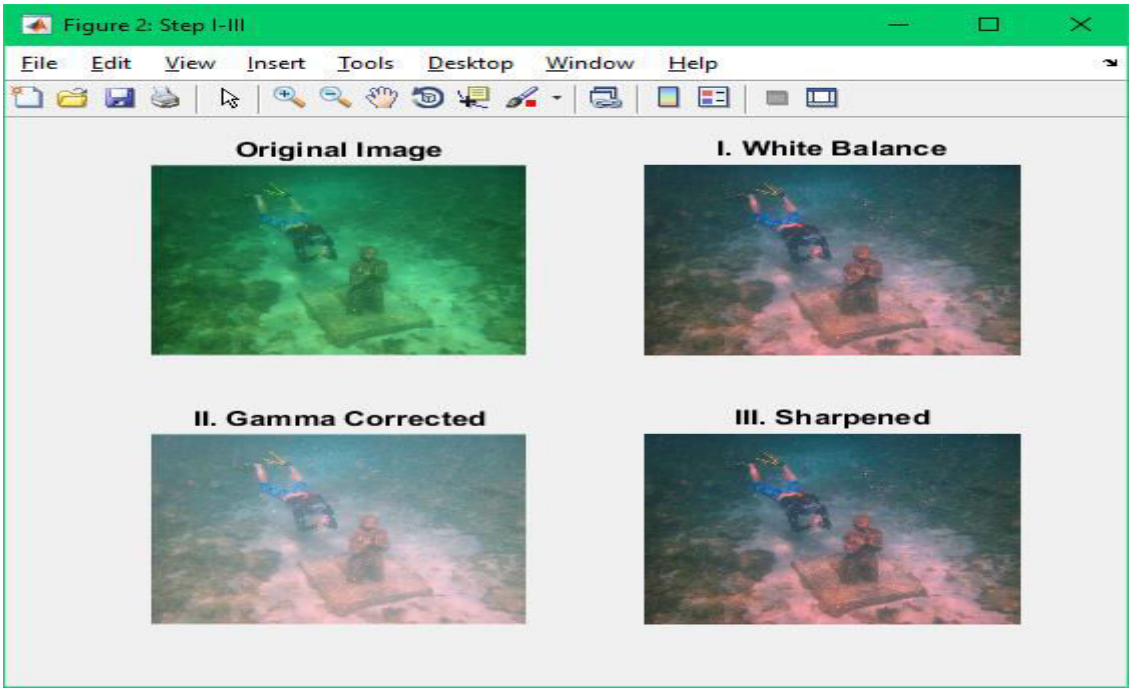

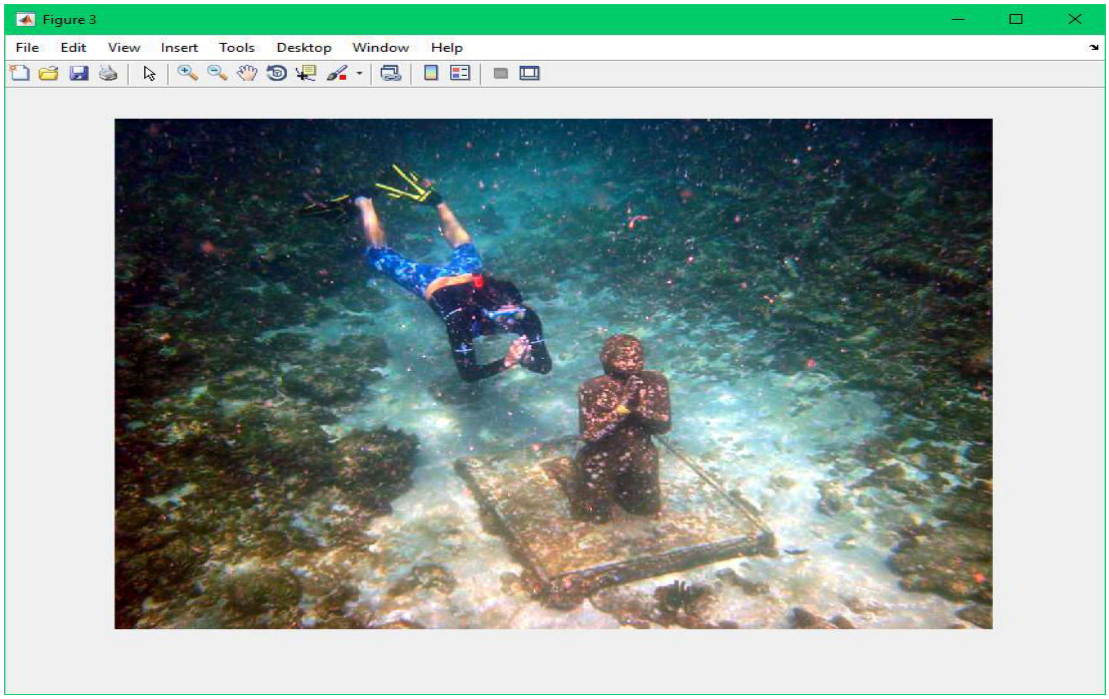

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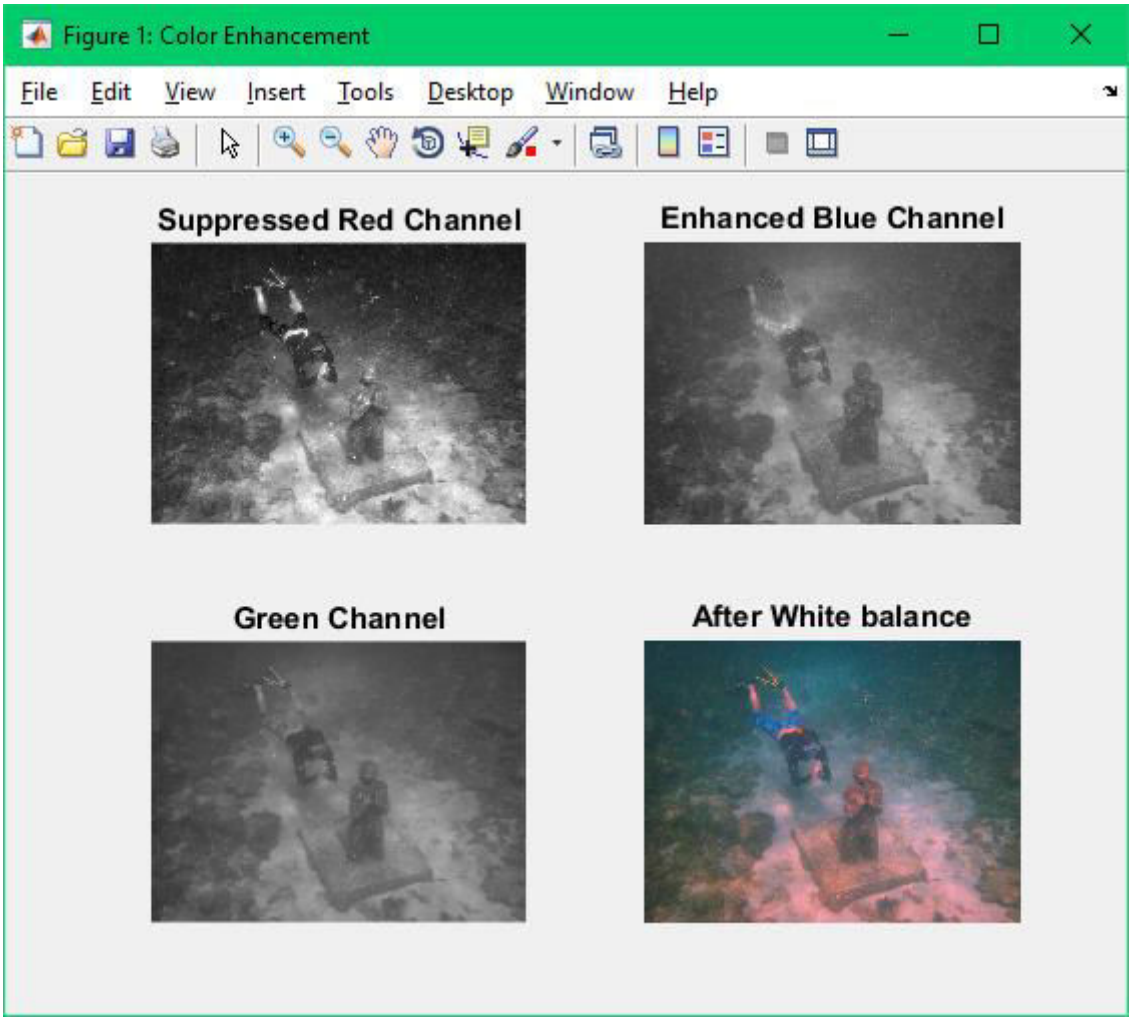

V. CONCLUSION AND FUTURE WORK

The visibility of objects at a distance long or short in underwater scene is a big problem in image processing. Even though, many methods are available for image enhancement, they have so many limitations. The proposed method takes into consideration the advantages of multiscale fusion and contrast enhancement technique. This method does not require any additional information other than the single original image. This input image is white balanced and this is classified into two steps, first by performing the gamma correction and then sharpening. The output of this two methods are subjected to an enhancement procedure. The weight maps of these inputs are calculated. The process is followed by a Multi Scale image decomposition of the inputs and estimation of normalized weight maps to obtain the final enhanced output. The method is suitable for recovering the significant features and edges which have been faded. The experiments showed that the proposed method improves the visual quality of underwater images. To boost underwater image processing, a suitable database of test images for different imaging conditions is still required. More studies have to be done in order to overcome the issue of color restoration for the images taken from a greater distance in underwater.

An underwater image enhancement scheme that combines individually degraded images and publicly available datasets for domain adaptation. Firstly, an underwater dataset fitting model (UDFM) is to merge the individual localized and

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publicly available degraded datasets into a combined degraded one. Then an underwater image enhancement model (UIEM) is developed base on the combined degraded and open available clear image pairs dataset.

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